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THE REVENUE CHARGEABLE TO PUBLIC USES OF WATER IN THE CITY OF ROCHESTER, NEW YORK[1]

BY STEPHEN B. STORY[2]

There are two sources from which the revenue of a water works system is derived, the private takers or consumers of the water and the public treasury. The latter source has not been drawn upon very heavily in some instances for the support of the water works plant, because costs of supplying water and other services for the public have been paid from the pockets of water takers. The city of Rochester, N. Y., has been and is no exception to the group of cities whose water departments or water companies are paid nothing or, at best, inadequately for the public service they provide.

City officials, boards of aldermen, boards of estimate, and boards of contract and supply apparently have had no conception that the water or services which they demand so freely for drinking fountains, street sprinkling and cleaning, or for fire protection cost money to provide and that, unless it is paid for from the public treasury, it must be paid via the water consumers' monthly or quarterly bills.

It is necessary to distinguish carefully between the meaning of the words "the public" and the meaning of the word "consumers" in discussing questions concerning water works. The words are not synonymous. It is true that water consumers taken as a mass constitute a large proportion of the population of a community, but they are not "the public." A water taker in his relation to the water works is a private consumer and not a constituent part of the public by virtue of that fact, for all the people who make up "the public" are not water takers. When we speak of public use of water we mean use of water for purposes from which the benefit derived is not local but general. The burden of expense incurred in providing water for public service has, in the main, been paid by the water takers, and public officials have been consistently blind to the fact that any inequity has existed. On January 1, 1877, one year after the Rochester Water Works were placed in full operation, the Chief Engineer, J. Nelson Tubbs, communicated to the Executive Board as follows:

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[1] Read before the Montreal Convention, June 24, 1920. Discussion is requested and should be sent to the Editor.

[2] Engineer, Bureau of Municipal Research, Rochester, N. Y.

> That at the end of each year there be charged on the books of the Water Department against the city, such an amount as would have been collected of an individual citizen for the same uses of the water. And I suggest that the amount charged for each fire hydrant should be $50 per year; for each public drinking trough $20; for each public fountain, $15 to $50; and for each school, engine house and other public buildings, at schedule rates. In short I recommend that a regular debit and credit account be kept with the city on the books of the Department on account of the water works.
>
> This will enable those in charge to report yearly to the citizens the financial standing of the Water Works in dollars and cents, making all proper charges against them, and also giving them all proper money credits. While such a statement cannot take into account the money value of increased public health and comfort, yet it will give the water works fund a credit to which it is fully entitled, but which has no significance to the average taxpayer unless presented to him as a matter of definite amounts in currency.

In practically all subsequent reports of the Water Works, covering a period of nearly fifty years, the principle of Mr. Tubbs' remarks has received recognition, and reference has been made to the matter in many different ways. Forty years after Mr. Tubbs made his recommendation the Rochester city officials recognized the principle, for in 1917 the Department of Public Works credited the Water Bureau with $70,000 for public use of water. Last year the Fire Bureau of the Department of Public Safety credited the Water Bureau with $35,000 for "use of water." In this year's budget provision has been made for the Department of Public Instruction to credit the Bureau $14,000 for water supplied to public schools and the Department of Engineering $7,000 for water supplied to public buildings. The budget total for departmental credits to the Water Bureau is $126,000. We may believe that the principle of payment by the public for public use of water is now established in this city.

The basis for these budgetary appropriations is "guess work" pure and simple, and not very good "guess work" at that. Some of the city departments are not paying anything, some are not paying enough, and some are paying too much.

Table 1 shows the metered water used for public purposes in the city in 1919. The cost of this water has been computed at 10 cents per thousand gallons, the lowest rate of the three rate sliding scale. The total cost of this metered water is a little over $20,000.

TABLE 1

Metered city services

DEPARTMENT	BUREAU	1919		
		Consumption	Consumption	Cost at 10 cents per 1000
		cu. ft.	*gallons*	
Parks	Parks	1,047,000	7,852,500	$785.25
	Playgrounds	1,061,800	7,963,500	796.35
	Total	2,108,800	15,816,000	$1,581.60
Public safety	Fire	2,400,700	18,005,250	$1,800.53
	Police	922,700	6,920,250	692.03
	Health	282,500	2,118,750	211.88
	Total	3,605,900	27,044,250	$2,704.43
Public instruction	Schools	13,879,300	104,094,750	$10,409.48
Mt. Hope	Cemetery	1,131,200	8,484,000	$848.40
Public works	Street and Sewer	653,600	4,902,000	$490.20
	Water	327,500	2,456,350	245.64
	Market	118,400	888,000	88.80
	Garage	38,500	288,750	28.88
	Total	1,138,000	8,535,000	$853.50
Exposition Park	Aquarium	115,800	876,500	$87.65
Engineering	Municipal buildings	1,558,200	11,686,500	$1,168,65
	City total			$17,653.71
New York State	Bridges	17,200	129,000	$12.90
Monroe County	Tuberculosis Hospital	3,250,300	24,377,250	2,437.73
Grand total				$20,104.34

Table 2 is a tabulation of the quantities of water used for public purposes which are not supplied through meters. These quantities are obtained by calculations based upon the best data obtainable. The total cost of this water at the wholesale rate is $46,000. The notes give in brief form the data from which the items of Table 2 have been computed.

TABLE 2

Unmetered water for public use, City of Rochester

	PURPOSE	QUANTITY	COST AT 10 CENTS PER 1000 GALLONS
A	Street flushing (by hand)	600,000	$60
B	Street flushing (by machine)	100,000,000	10,000
C	Street sweeping (by machine)	500,000	50
D	Street sprinkling	220,000,000	22,000
E	Sewer flushing (house laterals)	3,400,000	340
F	Sewer flushing (sewer laterals)	500,000	50
G	Sewer flushing (main sewers)	100,000	10
H	Snow removal flushing	3,000,000	300
I	Drinking fountains	1,000,000	100
J	Horse troughs	110,000,000	11,000
K	Parks and playgrounds	20,000,000	2,000
L	Exposition park	1,000,000	100
		460,100,000	$46,010

A. Street flushing (by hand). Measurements of water used for hand-flushing using 2½-inch hose, 1 inch smooth nozzle, hydrant pressure average 30 pounds, are 1,000 gallons per 1,000 square yards. Figures for area flushed from Street and Sewer Bureau.

B. Street flushing (by machine). Six working days per week; 30 weeks per year. Tank capacity; flusher No. 1, 1,250 gallons; flusher No. 2, 1,500 gallons; flusher No. 3, 1,500 gallons. Flusher No. 1, 29 fillings per day; flusher No. 2, 41 fillings per day; flusher No. 3, 44 fillings per day. Two additional flushers have been purchased of same type as flusher No. 3. Four wagon flushers with 60-gallon tanks, 56 fillings each per day. Add margin for waste in filling.

C. Street sweeping (by machine). Two Austin machine sweepers, 1,200 gallons per day, 200 working days. Double quantity required for working double shift as planned. Add margin for waste in filling.

D. Street sprinkling. Six days per week; 30 weeks in season. Forty tanks filled forty times per day. Tank capacity, 750 gallons. Allow margin for wastage in filling and temporary hydrant valves.

E. Sewer flushing (house laterals). 1,600 laterals flushed per year. 15 minutes per flushing is average time water is on. Hose and nozzle at 150 gallons per minute.

F. Sewer flushing (sewer laterals). 100 sewer laterals flushed per year. 30 minutes per flushing is average time water is on. Hose and nozzle at 150 gallons per minute.

G. Sewer flushing (main sewers). 11 sewers flushed per year. 60 minutes per flushing is average time water is on. Hose and nozzle at 150 gallons per minute.

H. Snow removal flushing. Varies yearly with amount of snow fall. Estimate 30 days flushing at 100,000 gallons per day.

I. Drinking fountains. Metered flow of fountain set up in meter shop was 25 gallons per hour. Run for five months per year. 12 fountains of this type attached to fire hydrants around city.

J. Horse troughs. Metered flow of one trough at 1,500,000 gallons per year. 75 troughs operating all year in city.

K. Parks and playgrounds. Estimate based on consideration of playgrounds and parks being about half metered.

L. Exposition park. Estimate well within the actual use.

Table 3 is a tabulation of special services and uses of water which are of a public character. A discussion of the three items of this table is necessary to indicate their place in the field of public use.

TABLE 3

Special services and uses of water which are of a public character

Item 1	Rebates to charitable institutions	$15,000
Item 2	Free water supplied to industrial school	3,000
Item 3	Fire protection	180,510
	Total	$198,510

Item 1. The rebating or reduction of water bills paid by charitable institutions. Some institutions which are dependent upon charity for all or a portion of their support receive a rebate upon their water bills. The percentage of rebate is not constant but varies, certain institutions receiving larger reductions than others, governed perhaps by their degree of "charitableness." The percentages of these rebates are as follows:

	per cent
Parochial schools and hospitals	90
Y. M. C. A., orphan asylums, children's homes, Salvation Army, Rochester Athletic Club, and University of Rochester	50
Convents	25

The amount of money rebated exceeds $15,000 per year. The worthiness of the objects of any of these institutions is not questionable, and it is not within the province of this paper to say whether or not the city should subsidize any or all of them, but it is certainly bad business to make donations to the support of institutions at the expense of the Water Bureau and under guise of a reduction in water bills. If the city is to make donations to any of these "charities" it should bill the water to the institution and collect for the same at full value. Such gifts as the city chooses to make should be made by direct appropriation.

Item 2. The water supplied by the water bureau to State Agricultural and Industrial School at Industry, N. Y. Under laws of 1910, Chapters 251 and 415, the city became a party to a transaction with the State for the removal of the school, then located at what is now Exposition Park, in the city of Rochester to a new site at Industry, N. Y. Exposition Park is a park equipped with buildings and facilities for exhibitions and expositions of various kinds. It is owned by the city but is leased to an operating association. One of the terms of this agreement was that the city would lay a cast iron pipe of a diameter greater than 8 inches from its conduits supplying Rush Reservoir to the School. The pipe to be maintained by the city, which means the Water Bureau, for as long a period as the city maintains and uses Hemlock Lake as a source of water supply. The city agreed to supply water to the School at prices charged consumers in the city and it further agreed to supply water in amounts up to 30,000,000 gallons per year without charge for a period of 25 years, dating from the completion of the pipe line.

In the nine years in which this agreement has been in force the Water Bureau has supplied a total of 229,000,000 gallons.

From a study of the gradual increase in use of water at this institution it is apparent that in 1921 the annual consumption will be in excess of 30,000,000 gallons. In each year the Water Bureau will contribute to the city's share of this agreement $3000. Its total contribution since the passage of the law has been $22,900, and the period for which it supplies free water has 16 years yet to run. At the rate of $3000 per year, this will amount to $48,000. Added to $22,900 already contributed, the total will be $70,900, the total value of water diverted to use at this institution.

It may be said that the Water Bureau received in exchange property which it now occupies for its shops and pipe yard and that free water supplied by the Bureau is its share of the payment for the property. The Bureau did receive this property, but it removed its shops and yards from other parcels of property located in sections of the city where values were much higher. These abandoned parcels were diverted to other city uses. It is doubtful if the exchange of property occupied by the Water Bureau meant any additional outlay on the part of the city for water purposes. And if it did, the $22,500 worth of water which the Water Bureau has already contributed to the State School has amply paid the balance. The organization which conducts and operates Exposition Park received the benefit of this arrangement with the State and the charge for "free" water supplied the Industrial and Agricultural School for the next fifteen years should be paid by that organization as an "operating charge" against the park. This amount is $3000 per year.

Item 3. Fire protection afforded the city by the Rochester water works. Fire protection, as defined from the water works standpoint, is the security afforded a community by virtue of the existence of the water system and its ability to furnish a supply of water in sufficient quantities and at sufficient velocities to extinguish all anticipated fires.

It is one of the great advantages of a water supply. The fire protection which a water system makes possible cannot be measured by the amount of water used in extinguishing fires. The estimated amount of water actually used is less than an average day's consumption. It is the ability to use this water when and where it is needed that makes the protection valuable. The statement that "a dollar's worth of water at meter rates may save from destruction property worth more than the cost of the entire water system" is as true as it is trite.

It should not require much argument to show that it costs the municipal water works no inconsiderable sum to provide this service. The water supply must be such that in addition to the water ordinarily consumed there is provision for emergency drafts to the extent of one and one-half times the daily consumption. The capacity of the mains has to be such that they will convey this water, in addition to their usual provision for domestic consumption, to the point or points at which it may be needed and at such a rate as to provide water for as many as 40 fire streams at once. Special construction in the nature of hydrants, etc., is necessary to make this water available. The expense of these items is borne by the Water Bureau. The task of determining the cost of this protection is not a simple one. The custom followed by many cities in making the determination of these charges has been to base them on averages of existing rates in nearby communities or by using the rates in cities of the same size. This method is slipshod and unscientific. This "hydrant rental," as it is usually called, has been the subject of much discussion among persons interested in rate determination. The correct and fair basis for determination of the cost of construction to provide fire protection is found by estimating the cost to provide the city with water *without* consideration for fire protection and then subtracting this sum from the actual cost. The remainder is the amount which is chargeable to fire protection. The determination of the annual charge can then be made. This annual charge should consist of two parts as:

1. A sum based upon the interest, depreciation and maintenance charges of that portion of the system that is chargeable to fire protection (this should exclude the cost of hydrants and connections).
2. A fixed sum per hydrant, consisting of interest, depreciation, repair, inspection and other maintenance charges, based on the cost of the hydrants and connections at the time of determination.

If there is no charge for fire protection, the cost of it must be collected from the water takers through the medium of water rates. The practice of supplying fire protection at the expense of the water consumers is based upon a principle which makes the use of water a measure of fire protection benefit. This principle is patently untenable. If the valuation of a man's property is an index of the value of fire protection to him, it is a measure of the benefit conferred. The quantity of water used or the use of a service connection has no relation to the measure of the benefit received. The most correct and equitable method of making the charge for fire protection is by direct taxation upon the community.

The protection afforded by two independent systems of water supply for Rochester may be discussed separately.

1. The Holly system. This system furnishes non-potable water at high pressure and is designed solely for fire protection. Its entire cost can be charged directly to this item. There are about two dozen consumers who use the Holly system for commercial purposes; their bills total about $600 per year.

The Holly system protects the congested value district and has a few ramifications outside. It affords fire protection of a special character to a special and definite district. Its protection is localized. The cost of this protection is paid by *water consumers* over the entire city. It is difficult to imagine why a water taker living in the Twenty-third Ward should pay as much as a shopkeeper on Court Street for the protection of the Holly system. The medium of collection is unfair in that fire protection is not a just charge against a water taker and the persons from whom the collection is made are not fairly chargeable. The expense of the Holly system should be charged as a local benefit against the property owners of the Holly district and as a direct assessment.

The total expense of the Holly system is about $43,000. This is itemized as follows:

Hydrants costs for 462 hydrants at $5.50 per year per hydrant.	$2,500
Maintenance of distribution system	6,000
Operation cost Holly pumping station	24,600
Interest on original outlay	10,000
	$43,100
Less revenue from Holly service	600
	$42,500

2. Hemlock system. This system supplies water of an excellent character for domestic and commercial use in addition to providing fire protection for the entire city. The dual nature of the Hemlock supply makes the work of allocating the cost attributable to fire protection somewhat more difficult.

As indicated heretofore, the correct method of making the computation of the fire protection charge is to deduct from the cost of the works as now existent the cost of works sufficient to supply domestic and commercial consumption alone and the difference is chargeable to fire protection. To this must be added the total for hydrant expense. The above computation can be made accurately only after a careful physical survey of the entire plant with a view to determining the difference in capacities and cost, had the system been constructed without consideration for fire service.

It is conceded by water works authorities that there is a relation, more or less well defined, between the percentage of the water works construction and operating costs relating to fire protection and the population of the city served. An examination of the data upon the subject indicates considerable variance in ideas but gives some ground for the drawing of general conclusions. In small communities the entire cost of water works is usually attributable to fire protection; there will, after the system is constructed, be a few takers. It is probable that, in communities of less than 5000, the percentage of the cost chargeable to fire protection is between 80 and 90 per cent. At the other extreme engineers have calculated that at the time when the population reaches about 375,000 the size of the system is such that the element of extra consideration due to fire needs is negligible because the capacity demanded by ordinary consumption is sufficient to fill the fire demand. Between these two extremes there may be plotted a general curve which will approximate this relation between fire provisions and the ordinary commercial and domestic consumption.

The paper presented by Metcalf, Kuichling and Hawley before the American Water Works Association at the convention of 1911 is a most able consideration of the question of determination of the correct charges for fire protection. The author has drawn upon their formulae[3] and discussion and made an application of them to the city of Rochester. If the population served by the Rochester Water Works is now 280,000, the percentage of the total cost of the system attributable to fire protection is slightly over 13 per cent. The 1920 appropriation is $900,000, and from this must be taken the hydrant expense computed as follows:

Average cost of hydrant set in place		$60.00
Interest	$2.70	
Depreciation	1.80	
Maintenance (repair, inspection, etc.)	1.00	
Total expense per hydrant	$5.50	5.50
Number of hydrants (exclusive of Holly system)		5,500
5500 hydrants at $5.50 per year each		$30,250.00

It is also necessary to deduct the Holly expense as estimated above. Thirteen per cent of the sum remaining is the charge for

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[3] See "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Fire Hydrant Service," by Leonard Metcalf, Emil Kuichling and William C. Hawley, *Proc. Am. Water Works Assoc.*, 1911, page 86. The formula is

$$y = \frac{147}{x^{0.31}} - 12.1$$

in which y is the percentage of total cost chargeable to fire protection and x is the population in thousands. If the population is taken at 280,000, the formula gives $y = 13$.

fire protection afforded by the Hemlock system. Thirteen per cent of $827,000 is $107,510.

The total fire protection charge for the entire city is

Hemlock system	$107,510
Hemlock hydrant charges	30,500
Holly system	42,250
	$180,260

When this sum is compared with the $35,000 allotted to the Water Bureau from the Fire Bureau for "use of water," we see how insufficient the appropriation is.

The total of the items of public use which are mentioned in this paper is as follows:

Metered public use	$20,104
Unmetered public use	46,010
Fire protection, etc	198,510
	$264,624

The Water Bureau now receives a sum of $126,000, which is the total paid by the public for the use of water. This amount is $138,600 less than what it should be to give the Water Bureau an adequate return for the service it renders.